0:00:00 –> 0:00:01.965 Funding for Yale Cancer Answers

0:00:01.965 –> 0:00:03.93 is provided by Smilow Cancer

0:00:03.997 –> 0:00:05.697 Hospital and AstraZeneca.

0:00:07.78 –> 0:00:09.814 Welcome to Yale Cancer Answers with

0:00:09.814 –> 0:00:12.159 your host doctor Anees Chagpar.

0:00:12.16 –> 0:00:14.02 Yale Cancer Answers features the

0:00:14.02 –> 0:00:16.302 latest information on cancer care by

0:00:16.302 –> 0:00:17.766 welcoming oncologists and specialists

0:00:17.766 –> 0:00:20.2 who are on the forefront of the

0:00:20.2 –> 0:00:21.99 battle to fight cancer. This week,

0:00:21.99 –> 0:00:23.74 it's a conversation about prostate

0:00:23.74 –> 0:00:25.669 cancer with Doctor Peter Humphrey.

0:00:25.67 –> 0:00:27.362 Doctor Humphrey is a professor of

0:00:27.362 –> 0:00:29.52 pathology at Yale School of Medicine,

0:00:29.52 –> 0:00:32.831 where Doctor Chagpar is a professor

0:00:32.831 –> 0:00:34.66 of surgical oncology.

0:00:34.67 –> 0:00:36.371 Peter, maybe we can start off by you

0:00:36.371 –> 0:00:38.068 telling us a little bit about

0:00:38.068 –> 0:00:40.08 yourself and what you do.

0:00:40.11 –> 0:00:42.11 I'm a practicing surgical pathologist

0:00:42.11 –> 0:00:44.61 which basically means that I

0:00:44.61 –> 0:00:47.62 look at a glass slide under a

0:00:47.62 –> 0:00:50.258 microscope and render a diagnosis,

0:00:50.258 –> 0:00:54.021 often cancer diagnosis on tissues that

0:00:54.021 –> 0:00:56.606 we received from other physicians,

0:00:56.61 –> 0:01:01.58 including biopsies and and resections,

0:01:01.58 –> 0:01:04.639 and so microscopes have always interested me.

0:01:04.64 –> 0:01:07.763 Ever since I was very young and

0:01:07.763 –> 0:01:10.091 looked through a microscope at pond

0:01:10.091 –> 0:01:13.49 water when I was in elementary school,

0:01:13.49 –> 0:01:15.583 but it was actually taking

0:01:15.583 –> 0:01:18.127 care of a patient in medical school

0:01:18.13 –> 0:01:20.938 that really helped direct me into

0:01:20.938 –> 0:01:25.06 pathology and if I can give that story.

0:01:25.06 –> 0:01:28.66 I was a third year

0:01:28.66 –> 0:01:29.46 medical student and

0:01:29.46 –> 0:01:33.078 hadn't really decided on a specialty.

0:01:33.08 –> 0:01:34.785 And was considering a number

0:01:34.785 –> 0:01:35.808 of different specialties,

0:01:35.81 –> 0:01:38.46 including medicine and internal medicine.

0:01:38.46 –> 0:01:41.408 Pathology wasn't so

0:01:41.408 –> 0:01:45.093 high on the list until

0:01:45.1 –> 0:01:48.39 there was an occurrence with one

0:01:48.39 –> 0:01:51.467 patient and she was on the internal

0:01:51.467 –> 0:01:54.47 medicine ward and she had rib pain

0:01:54.556 –> 0:01:57.64 and the radiologists were able to

0:01:57.64 –> 0:02:01.269 identify a lesion in the rib and

0:02:01.269 –> 0:02:03.185 the differential diagnosis that

0:02:03.185 –> 0:02:05.58 we considered clinically and the

0:02:05.65 –> 0:02:08.988 radiologist considered was quite lengthy

0:02:08.988 –> 0:02:13.017 so it really took a biopsy which

0:02:13.017 –> 0:02:15.699 then went to surgical pathology and

0:02:15.7 –> 0:02:17.698 in order to establish the diagnosis,

0:02:17.7 –> 0:02:20.832 and so I I went down to surgical pathology.

0:02:20.84 –> 0:02:23.605 the laboratory where the attending

0:02:23.605 –> 0:02:25.817 surgical pathologist was looking,

0:02:25.82 –> 0:02:28.16 at slides with their resident

0:02:28.16 –> 0:02:31.157 on the service and I asked if they

0:02:31.157 –> 0:02:33.185 had seen the biopsy from this

0:02:33.263 –> 0:02:36.119 particular patient and he said he had,

0:02:36.12 –> 0:02:38.64 and then he pulled out the slide

0:02:38.64 –> 0:02:41.192 and went through it and in pretty

0:02:41.192 –> 0:02:42.588 short order said oh,

0:02:42.59 –> 0:02:44.7 this is metastatic cancer from

0:02:44.7 –> 0:02:45.966 the salivary gland,

0:02:45.97 –> 0:02:48.996 which was a diagnosis that was not

0:02:48.996 –> 0:02:51.486 really considered in this patient.

0:02:51.49 –> 0:02:54.118 It turns out she did have a history of

0:02:54.118 –> 0:02:56.486 salivary gland cancer 10 years prior

0:02:58.18 –> 0:03:00.844 so it occurred to me that this was

0:03:00.844 –> 0:03:03.525 the way to really help patients

0:03:03.525 –> 0:03:05.945 by helping render diagnosis.

0:03:08.14 –> 0:03:10.108 I find that fascinating, because certainly

0:03:10.108 –> 0:03:12.798 if you had a patient with rib pain,

0:03:12.8 –> 0:03:15.425 metastatic cancer from a salivary

0:03:15.425 –> 0:03:17.85 gland would not be top of the list.

0:03:17.85 –> 0:03:21.413 Did the pathologist know about the distant

0:03:21.413 –> 0:03:24.059 diagnosis of salivary gland cancer?

0:03:24.14 –> 0:03:26.04 I think this particular

0:03:26.04 –> 0:03:28.415 cancer was so distinctive that

0:03:28.415 –> 0:03:31.386 he was able to suspect salivary

0:03:31.386 –> 0:03:33.314 gland cancer right away.

0:03:33.32 –> 0:03:34.88 I'm not sure if he knew the history,

0:03:34.88 –> 0:03:36.976 but he was an excellent

0:03:36.976 –> 0:03:38.212 surgical pathologist and being

0:03:38.212 –> 0:03:39.536 an excellent surgical pathologist

0:03:39.54 –> 0:03:41.55 I'm sure he had asked the

0:03:41.55 –> 0:03:43.36 resident for the history first,

0:03:43.36 –> 0:03:45.864 as they examined the slide.

0:03:46.31 –> 0:03:49.68 Yeah, it's just absolutely fascinating,

0:03:49.68 –> 0:03:52.05 but now you've kind of transitioned

0:03:52.05 –> 0:03:53.63 still looking at cancers,

0:03:53.63 –> 0:03:56.178 but now you're into the world

0:03:56.178 –> 0:03:58.401 of genitourinary pathology,

0:03:58.401 –> 0:04:01.129 tell us a little bit more about how

0:04:01.129 –> 0:04:03.91 your interests transitioned to that.

0:04:06.7 –> 0:04:09.52 In residency a big

0:04:09.52 –> 0:04:11.776 part of pathology residency,

0:04:11.78 –> 0:04:13.32 which is pretty broad based,

0:04:13.32 –> 0:04:17.352 we rotate through a number of different

0:04:17.352 –> 0:04:19.626 services, subspecialty services and

0:04:19.626 –> 0:04:22.356 those services work with specific

0:04:22.36 –> 0:04:25 clinicians and it's disease

0:04:25 –> 0:04:28.717 focused and usually organ site

0:04:28.72 –> 0:04:32.05 focused. For example,

0:04:32.05 –> 0:04:34.29 as a genitourinary pathologist,

0:04:34.29 –> 0:04:37.71 I interact very closely with the

0:04:37.71 –> 0:04:39.99 urologist and medical oncologist

0:04:40.078 –> 0:04:43.052 to treat urological cancers as well

0:04:43.052 –> 0:04:45.324 as radiologist and interventional

0:04:45.324 –> 0:04:47.342 radiologists to deal with these

0:04:47.342 –> 0:04:48.812 type of cancers and specifically

0:04:48.812 –> 0:04:50.609 for the genitourinary system,

0:04:50.61 –> 0:04:53.34 this is just an introduction.

0:04:53.34 –> 0:04:57.267 We basically address cancers that arise in

0:04:57.267 –> 0:05:01.239 the prostate and testis and bladder and

0:05:01.24 –> 0:05:06.288 kidney, so it turns out when you are

0:05:06.29 –> 0:05:07.808 in formative years,

0:05:07.808 –> 0:05:10.338 one should never underestimate

0:05:10.338 –> 0:05:13.808 how a single patient or a physician

0:05:13.808 –> 0:05:17.575 can impact the development of

0:05:17.575 –> 0:05:20.42 the individuals who are young and

0:05:20.42 –> 0:05:22.83 deciding in medical school or pathology.

0:05:24.57 –> 0:05:27.762 So I was a first year resident and

0:05:27.762 –> 0:05:31.242 I rotated through the VA hospital

0:05:31.242 –> 0:05:33.246 which was right across from Duke

0:05:33.246 –> 0:05:34.15 University Hospital,

0:05:34.15 –> 0:05:37.034 which is where I did my residency.

0:05:37.04 –> 0:05:39.35 And there was a fascinating rotation,

0:05:39.35 –> 0:05:41.278 and another excellent surgical

0:05:41.278 –> 0:05:43.688 pathologist was the attending there,

0:05:43.69 –> 0:05:47.09 and we saw quite a lot of prostate cancer.

0:05:47.94 –> 0:05:51.06 And at the VA hospital,

0:05:51.06 –> 0:05:54.554 this was several decades ago,

0:05:54.554 –> 0:05:57.9 dating myself a number of decades ago,

0:05:57.9 –> 0:05:59.668 there was not much known about

0:05:59.668 –> 0:06:00.764 prostate cancer,

0:06:00.764 –> 0:06:03.504 and treatments were relatively limited,

0:06:03.51 –> 0:06:05.734 so it seemed to me that this was

0:06:05.734 –> 0:06:06.78 an area where

0:06:06.78 –> 0:06:10.26 there is much to be learned about diagnosis

0:06:10.26 –> 0:06:13.415 and prognosis as well as treatment of

0:06:13.42 –> 0:06:14.674 that particular cancer.

0:06:14.674 –> 0:06:17.182 So that's really how I became

0:06:17.182 –> 0:06:19.4 interested as a first year

0:06:19.4 –> 0:06:21 pathology resident in

0:06:21 –> 0:06:21.822 genitourinary cancers,

0:06:21.822 –> 0:06:23.466 and specifically prostate cancer

0:06:24.16 –> 0:06:26.17 Let's dive a little

0:06:26.17 –> 0:06:28.06 bit more into prostate cancer.

0:06:28.06 –> 0:06:31.093 I think that so much of again,

0:06:31.1 –> 0:06:33.557 what we do is really dictated by

0:06:33.557 –> 0:06:35.62 the biopsies that we take.

0:06:35.62 –> 0:06:38.29 So if somebody has

0:06:38.29 –> 0:06:41.682 a mass in the prostate or an enlarged

5

0:06:41.682 –> 0:06:43.433 prostate, even more globally,

0:06:43.433 –> 0:06:46.079 sometimes a biopsy will be done,

0:06:46.08 –> 0:06:48.24 and that'll be sent to the

0:06:48.24 –> 0:06:50.255 pathologist and it's really up to

0:06:50.255 –> 0:06:52.784 you to try to figure out is this

0:06:52.784 –> 0:06:55.856 cancer or is this something benign?

0:06:55.86 –> 0:06:57.228 And if it's cancer,

0:06:57.228 –> 0:07:00.283 how bad of a cancer is it which

0:07:00.283 –> 0:07:02.127 really dictates

0:07:02.13 –> 0:07:04.786 is this something that we treat at all,

0:07:04.79 –> 0:07:08.69 or something that we simply watch?

0:07:08.69 –> 0:07:11.43 How do you make those decisions?

0:07:11.43 –> 0:07:14.79 How do you make that differentiation from

0:07:14.79 –> 0:07:17.857 benign to malignant and within malignant,

0:07:17.86 –> 0:07:20.518 the different grades of prostate cancer?

0:07:21.12 –> 0:07:23.694 So it's really quite a long

0:07:23.694 –> 0:07:26.597 educational process to be able to

0:07:26.597 –> 0:07:28.809 diagnose benign versus malignant,

0:07:28.81 –> 0:07:31.258 and it turns out that what's so fascinating

0:07:31.258 –> 0:07:33.91 is that every single biopsy is different,

0:07:33.91 –> 0:07:36.39 even if we render an

0:07:36.39 –> 0:07:38.39 umbrella diagnosis of benign tissue.

0:07:38.39 –> 0:07:41.398 For example, the lining tissue of the prostate.

0:07:41.4 –> 0:07:43.272 There could be a number of

0:07:43.272 –> 0:07:44.82 benign mimicker's in there,

0:07:44.82 –> 0:07:46.46 meaning benign tissue looking

0:07:46.46 –> 0:07:48.659 like cancer under the microscope,

0:07:48.66 –> 0:07:52.51 but it's not, and we have

0:07:54.79 –> 0:07:55.55 a differential diagnosis.

0:07:55.55 –> 0:07:57.47 We consider a number of different

0:07:57.47 –> 0:07:58.75 benign entities before deciding

0:07:58.799 –> 0:08:00.027 on a malignant diagnosis,

0:08:00.03 –> 0:08:02.291 because that's such a huge step

0:08:02.291 –> 0:08:04.77 to take for us and for the patient

0:08:04.77 –> 0:08:08.8 and the patient's treating physician.

0:08:08.8 –> 0:08:11.218 So that's what I particularly enjoy,

0:08:14.41 –> 0:08:16.245 that diagnostic work and it

0:08:16.245 –> 0:08:17.713 can be arduous sometimes.

0:08:17.72 –> 0:08:19.64 Sometimes it's very straightforward

0:08:19.64 –> 0:08:23.054 that a particular biopsy is benign

0:08:23.054 –> 0:08:25.082 and sometimes straightforward that

0:08:25.082 –> 0:08:27.393 it's malignant, but other times

0:08:27.393 –> 0:08:29.548 there are benign conditions under

0:08:29.548 –> 0:08:31.91 the microscope that look like cancer

0:08:31.91 –> 0:08:34.058 and cancer that can look benign.

0:08:34.06 –> 0:08:36.671 So we've been fortunate in this area

0:08:36.671 –> 0:08:39.924 to have some tools to help us and

0:08:39.924 –> 0:08:41.979 those include antibodies that can

0:08:42.058 –> 0:08:44.95 help us recognize specific cells under

0:08:44.95 –> 0:08:47.402 the microscope and in certain cases

0:08:47.402 –> 0:08:50.04 that can be relayed to us,

0:08:50.04 –> 0:08:52.842 but it still requires judgment and

0:08:52.842 –> 0:08:55.603 having formed a differential diagnosis

0:08:55.603 –> 0:08:57.858 or consideration of what's possible

0:08:57.858 –> 0:09:00.178 before we order those tests.

0:09:00.18 –> 0:09:01.518 On that issue,

0:09:01.518 –> 0:09:03.748 so once having established a

0:09:03.748 –> 0:09:05.6 diagnosis of malignancy,

0:09:05.6 –> 0:09:08.534 then the next step is to decide and this

0:09:08.534 –> 0:09:11.437 is so important for prostate cancer,

0:09:11.44 –> 0:09:12.972 how aggressive is it?

0:09:12.972 –> 0:09:15.797 Because it turns out most men who

0:09:15.797 –> 0:09:17.83 have prostate cancer will die

0:09:17.83 –> 0:09:19.87 with it rather than of it.

0:09:19.87 –> 0:09:22.579 So there are a large number of

0:09:22.579 –> 0:09:24.517 prostate cancers that can grow

0:09:24.517 –> 0:09:26.617 very slowly and may not affect

0:09:26.617 –> 0:09:29.18 the man during his lifetime,

0:09:29.18 –> 0:09:31.23 yet it turns out that

0:09:31.23 –> 0:09:34.428 prostate cancer is the second most

0:09:34.428 –> 0:09:36.97 lethal cancer amongst American men

0:09:36.97 –> 0:09:38.311 by total numbers

0:09:38.311 –> 0:09:40.546 trailing only lung cancer.

0:09:40.55 –> 0:09:43.259 So those are the cancers we want

0:09:43.259 –> 0:09:45.225 to specifically separate out from

0:09:45.225 –> 0:09:47.065 the more slowly growing ones.

0:09:47.07 –> 0:09:49.485 And we do that under the microscope

0:09:49.485 –> 0:09:52.001 using a very powerful approach

0:09:52.001 –> 0:09:54.527 that is grade, as you suggest.

0:09:54.53 –> 0:09:56.51 So what is grade?

0:09:56.51 –> 0:09:59.144 It's basically the way the cells

0:09:59.144 –> 0:10:01.37 grow within the prostate once

0:10:01.37 –> 0:10:04.34 we've identified them as cancer cells,

0:10:04.34 –> 0:10:06.279 so we can look under the microscope

0:10:06.279 –> 0:10:07.11 and in their patterns

0:10:07.11 –> 0:10:09.545 there are specific patterns that

0:10:09.545 –> 0:10:12.52 are known to correlate with the

0:10:12.52 –> 0:10:14.34 outcome for the patient,

0:10:14.34 –> 0:10:17.416 and so we have various tiers,

0:10:17.416 –> 0:10:20.246 various numbers we can apply

0:10:20.25 –> 0:10:22.294 and the most simple one that we

0:10:22.294 –> 0:10:24.458 use right now is grade group and

0:10:24.458 –> 0:10:26.288 that ranges from one to five.

0:10:26.29 –> 0:10:29.25 One being the best outcome,

0:10:29.25 –> 0:10:31.075 and those patients are managed

0:10:31.075 –> 0:10:32.17 very differently from

0:10:32.17 –> 0:10:34.546 those who have a grade group

0:10:34.546 –> 0:10:36.13 five out of five,

0:10:36.13 –> 0:10:37.68 but there's everything in between,

0:10:37.68 –> 0:10:39.37 so it's really a spectrum.

0:10:39.37 –> 0:10:41.474 And therein lies again

0:10:41.474 –> 0:10:46.396 judgment as far as deciphering as you note,

0:10:46.4 –> 0:10:48.332 the detective work deciphering

0:10:48.332 –> 0:10:51.23 out the patterns that can help

0:10:51.318 –> 0:10:53.41 us assign a grade that

0:10:53.41 –> 0:10:54.55 indicates aggressiveness of

0:10:54.55 –> 0:10:56.56 that prostate cancer.

0:10:57.99 –> 0:11:00.07 One of the questions

0:11:00.07 –> 0:11:01.955 that I think always comes up is

0:11:01.955 –> 0:11:04.013 that it seems to be a little bit

0:11:04.013 –> 0:11:06.08 of art and a little bit of science.

0:11:06.08 –> 0:11:09.23 Looking at these patterns

0:11:09.23 –> 0:11:11.74 and trying to decipher is this

0:11:11.74 –> 0:11:13.156 lower grade?

0:11:13.156 –> 0:11:14.926 Is this a higher grade?

0:11:14.93 –> 0:11:18.226 How much of it is art,

0:11:18.23 –> 0:11:20.982 and how much of it is science

0:11:20.982 –> 0:11:24.168 and how sure are you at any given

0:11:24.168 –> 0:11:26.959 time of your diagnosis being correct?

0:11:27 –> 0:11:30.15 Interpretation of slides

0:11:30.15 –> 0:11:33.533 under the microscope is most definitely

0:11:33.533 –> 0:11:36.702 both art and science, so there's

0:11:36.702 –> 0:11:38.988 much experience that one must have

0:11:38.988 –> 0:11:41.76 in order to recognize these patterns.

9

0:11:41.76 –> 0:11:44.856 The science part is that we can use

0:11:44.856 –> 0:11:47.997 antibodies to help identify specific cells.

0:11:48 –> 0:11:49.67 The grading part remains, though,

0:11:49.67 –> 0:11:52.88 very much art and pattern recognition

0:11:52.88 –> 0:11:54.37 going forward in the future,

0:11:54.37 –> 0:11:55.99 and this has already started.

0:11:55.99 –> 0:11:59.158 We have tools that can help us recognize

0:11:59.158 –> 0:12:02 patterns even better and more quantitatively,

0:12:02 –> 0:12:05.57 and that's through the use of artificial

0:12:05.658 –> 0:12:08.33 intelligence and machine learning.

0:12:08.33 –> 0:12:10.41 So all of that work has just started,

0:12:10.41 –> 0:12:12.42 but already I've had the opportunity

0:12:12.42 –> 0:12:14.874 to work in on a couple different

0:12:14.874 –> 0:12:17.645 projects and it turns out that the

0:12:17.645 –> 0:12:19.757 computer with specific algorithms

0:12:19.76 –> 0:12:20.644 can identify,

0:12:20.644 –> 0:12:22.854 can diagnose and grade prostate

0:12:22.854 –> 0:12:25.531 cancers just as well as a number

0:12:25.531 –> 0:12:27.445 of us who specialize in sub

0:12:27.517 –> 0:12:30.197 specializing in that particular area.

0:12:30.95 –> 0:12:33.398 I can't wait to learn more about that,

0:12:33.4 –> 0:12:35.22 but first we need to take a

0:12:35.22 –> 0:12:36.98 short break for medical minute.

0:12:36.98 –> 0:12:39.535 Please stay tuned to learn more about

0:12:39.535 –> 0:12:41.415 prostate cancer diagnosis and prognosis

0:12:41.415 –> 0:12:43.587 with my guest doctor Peter Humphrey.

0:12:44.38 –> 0:12:46.355 Funding for Yale Cancer Answers

0:12:46.355 –> 0:12:48.33 comes from AstraZeneca, dedicated

0:12:48.398 –> 0:12:50.283 to advancing options and providing

0:12:50.283 –> 0:12:52.66 hope for people living with cancer.

0:12:52.66 –> 0:12:53.818 More information at

0:12:55.96 –> 0:12:57.98 astrazeneca-us.com.

0:12:57.98 –> 0:13:00.104 The American Cancer Society

0:13:00.104 –> 0:13:02.444 estimates that nearly 150,000 people

0:13:02.444 –> 0:13:05.048 in the US will be diagnosed with

0:13:05.048 –> 0:13:07.019 colorectal cancer this year alone.

0:13:07.02 –> 0:13:08.668 When detected early, colorectal

0:13:08.668 –> 0:13:11.14 cancer is easily treated and highly

0:13:11.208 –> 0:13:12.858 curable and men and women over

0:13:12.858 –> 0:13:15.268 the age of 45 should have regular

0:13:15.268 –> 0:13:17.764 colonoscopies to screen for the disease.

0:13:17.77 –> 0:13:19.142 Patients with colorectal cancer

0:13:19.142 –> 0:13:21.2 have more hope than ever before,

0:13:21.2 –> 0:13:24.104 thanks to increased access to advanced

0:13:24.104 –> 0:13:26.04 therapies and specialized care.

0:13:26.04 –> 0:13:27.896 Clinical trials are currently

0:13:27.896 –> 0:13:29.752 underway at federally designated

0:13:29.752 –> 0:13:31.19 Comprehensive Cancer Centers.

0:13:31.19 –> 0:13:33.35 Such as Yale Cancer Center and

0:13:33.35 –> 0:13:35.313 at Smilow Cancer Hospital to

0:13:35.313 –> 0:13:37.113 test innovative new treatments

0:13:37.113 –> 0:13:38.936 for colorectal cancer. Tumor

0:13:38.936 –> 0:13:41.266 gene analysis has helped improve

0:13:41.266 –> 0:13:43.13 management of colorectal cancer

0:13:43.195 –> 0:13:45.425 by identifying the patients most

0:13:45.425 –> 0:13:47.655 likely to benefit from chemotherapy

0:13:47.724 –> 0:13:49.428 and newer targeted agents,

0:13:49.43 –> 0:13:52.268 resulting in more patient specific treatment.

0:13:52.27 –> 0:13:55.33 More information is available at

0:13:55.33 –> 0:13:56.626 yalecancercenter.org. You're listening

0:13:56.626 –> 0:13:58.354 to Connecticut Public Radio.

0:13:59.32 –> 0:14:01.516 Welcome back to Yale Cancer Answers.

0:14:01.52 –> 0:14:04.22 This is doctor Anees Chagpar and I'm joined

0:14:04.22 –> 0:14:06.578 tonight by my guest doctor Peter Humphrey.

0:14:06.58 –> 0:14:08.44 We're talking about prostate

0:14:08.44 –> 0:14:10.3 cancer diagnosis and prognosis,

0:14:10.3 –> 0:14:13.359 and right before the break we were

0:14:13.359 –> 0:14:15.694 talking about this magic that

0:14:15.694 –> 0:14:18.049 happens in the pathology lab.

0:14:18.05 –> 0:14:20.489 At least, it seems like magic to those of

0:14:20.489 –> 0:14:22.93 us who send them biopsies and magically

0:14:22.93 –> 0:14:25.322 get back a diagnosis that we then

0:14:25.322 –> 0:14:27.478 use to treat our patients and Doctor

0:14:27.48 –> 0:14:29.419 Humphrey was telling us that this is

0:14:29.42 –> 0:14:30.383 in part art,

0:14:30.383 –> 0:14:33.043 but it is in part science and

0:14:33.043 –> 0:14:35.521 that you're able to use antibodies

0:14:35.521 –> 0:14:39.268 and so on to help you in making

0:14:39.268 –> 0:14:41.865 that diagnosis and right

0:14:41.865 –> 0:14:44.987 before the break you started to talk

0:14:44.987 –> 0:14:47.21 Doctor Humphrey about artificial

0:14:47.21 –> 0:14:50.75 intelligence and how this might actually

0:14:50.75 –> 0:14:55.35 help us in making a diagnosis now,

0:14:55.35 –> 0:14:56.985 so that the computers might

0:14:56.985 –> 0:14:59.43 be able to make a diagnosis

0:14:59.43 –> 0:15:01.565 almost as well as an experienced pathologist.

0:15:01.565 –> 0:15:04.067 Tell us a little bit more about that.

0:15:04.71 –> 0:15:09.047 So we are in the very early pilot stage

0:15:09.047 –> 0:15:11.616 I would say as far as

0:15:11.616 –> 0:15:13.629 development of this tool,

0:15:13.63 –> 0:15:15.846 but I think it will be an important

0:15:15.846 –> 0:15:18.066 tool that can assist the pathologist

0:15:18.066 –> 0:15:19.634 and actually artificial intelligence

0:15:19.634 –> 0:15:21.544 is being developed in many

0:15:21.544 –> 0:15:23.5 branches of medicine and

0:15:23.5 –> 0:15:25.866 radiology too, so it turns out

0:15:25.866 –> 0:15:28.32 that those parts of medicine that

0:15:28.32 –> 0:15:30.43 deal with diagnostic images like

0:15:30.5 –> 0:15:32.69 radiology and pathology are areas

0:15:32.69 –> 0:15:35.34 where there could be great benefit.

0:15:35.34 –> 0:15:39.138 From more standardization, I would say,

0:15:39.14 –> 0:15:41.844 and perhaps even quantitation,

0:15:41.844 –> 0:15:44.548 using computer assisted methods,

0:15:44.55 –> 0:15:46.44 so that's already happening and

0:15:46.44 –> 0:15:47.952 actually happening very quickly

0:15:47.952 –> 0:15:50.106 as far as the research into this.

0:15:50.11 –> 0:15:53.41 And the use of computers and

0:15:53.41 –> 0:15:54.51 artificial intelligence.

0:15:54.51 –> 0:15:58.722 To develop algorithms, ways in which

0:15:58.722 –> 0:16:02.189 the computer can diagnose and

0:16:02.189 –> 0:16:04.907 even grade prostate cancer.

0:16:04.91 –> 0:16:07.031 So I've been fortunate enough to have

0:16:07.031 –> 0:16:09.118 been involved in a couple of these

0:16:09.118 –> 0:16:11.134 research studies and a number of us

0:16:11.134 –> 0:16:12.772 from around the world who

0:16:12.772 –> 0:16:14.738 are interested in prostate cancer

0:16:14.738 –> 0:16:16.848 and are genitourinary pathologists,

0:16:16.85 –> 0:16:18.509 and we've looked at hundreds of slides,

0:16:18.51 –> 0:16:20.016 all online,

0:16:20.016 –> 0:16:23.028 so these are all images diagnosable

0:16:23.028 –> 0:16:24.354 on our computer.

0:16:24.354 –> 0:16:27.462 And then we tested the algorithm and then

0:16:30.275 –> 0:16:33.035 the algorithm was tested against our

0:16:33.113 –> 0:16:35.476 diagnosis in grade versus collections

0:16:35.476 –> 0:16:38.598 of pathologists who were

0:16:38.6 –> 0:16:40.865 not sub specialized in

0:16:40.865 –> 0:16:43.173 prostate cancer diagnosis and the

0:16:43.173 –> 0:16:46.131 computer was actually just as good

0:16:46.131 –> 0:16:49.138 as our diagnosis and grading.

0:16:49.14 –> 0:16:51.82 So what does this mean for the future?

0:16:51.82 –> 0:16:53.94 Well, there are actually a lot of challenges.

0:16:55.148 –> 0:16:56.658 There are several algorithms that

0:16:56.658 –> 0:16:58.24 have already been published.

0:16:58.24 –> 0:17:00.85 Methods that the computer uses,

0:17:00.85 –> 0:17:03.622 and there's a lot of standardization

0:17:03.622 –> 0:17:06.234 and validation that needs to occur

0:17:06.234 –> 0:17:07.939 so that a computer can use

0:17:07.94 –> 0:17:10.898 images from a particular laboratory

0:17:10.898 –> 0:17:13.613 and one particular hospital as far

0:17:13.613 –> 0:17:15.93 as the scanners they use to make

0:17:15.93 –> 0:17:18.591 those images and the way the slides

0:17:18.591 –> 0:17:20.756 are prepared that all of those

0:17:20.756 –> 0:17:23.478 factors can have a huge impact on the

0:17:23.478 –> 0:17:25.986 success or failure of the algorithms.

0:17:25.99 –> 0:17:28.694 My hope is that as far as standardization,

0:17:28.7 –> 0:17:31.472 it can be used as a tool to help

0:17:31.472 –> 0:17:33.931 hospitals where there may not be ready

0:17:33.931 –> 0:17:36.86 access to a genitourinary pathologist.

0:17:36.86 –> 0:17:38.253 And also I think for those of

0:17:38.253 –> 0:17:39.539 us who have high volumes

0:17:39.54 –> 0:17:42.204 and have a special sub specialized group

0:17:42.204 –> 0:17:45.157 of Geo pathologist as we do here at Yale,

0:17:45.16 –> 0:17:46.88 I think it might actually

0:17:46.88 –> 0:17:48.256 help us screen cases.

0:17:48.26 –> 0:17:50.801 So that the computer could actually help

0:17:50.801 –> 0:17:53.549 us identify through all these slides,

0:17:53.55 –> 0:17:56.916 identify the ones that need particular

0:17:56.916 –> 0:17:58.731 attention or standardized grading.

0:17:58.731 –> 0:18:00.399 So there may be,

0:18:00.4 –> 0:18:01.128 for example,

0:18:01.128 –> 0:18:03.312 a difference of opinion about the

0:18:03.312 –> 0:18:05.502 grade of a specific cancer and

0:18:05.502 –> 0:18:07.074 the way we currently address this,

0:18:07.08 –> 0:18:08.61 and this is very important actually

0:18:08.61 –> 0:18:10.4 when there's a difficult case,

0:18:10.4 –> 0:18:12.88 we'll have a consensus conference,

0:18:12.88 –> 0:18:15.344 meaning that up to seven of us

0:18:15.344 –> 0:18:17.938 who are sub specialized in

0:18:17.94 –> 0:18:19.3 genitourinary pathology at Yale will meet

0:18:19.3 –> 0:18:21.638 around the microscope or in this area,

0:18:21.64 –> 0:18:23.695 from our computers and look

0:18:23.695 –> 0:18:26.122 at the images together to try

0:18:26.122 –> 0:18:27.835 to agree on a particular grade.

0:18:27.835 –> 0:18:30.239 In a difficult case or where it's a

0:18:30.239 –> 0:18:32.315 borderline case between grades for example.

0:18:32.32 –> 0:18:35.41 So maybe the computer could also

0:18:35.41 –> 0:18:38.309 provide help in standardizing those.

0:18:38.31 –> 0:18:40.315 Those sorts of assessments when

0:18:40.315 –> 0:18:42.71 it's a difficult or borderline case,

0:18:43.44 –> 0:18:46.832 so it sounds like this is really exciting

0:18:46.832 –> 0:18:49.619 technology that might be able to provide

0:18:49.62 –> 0:18:53.407 a second opinion. But for right now,

0:18:53.41 –> 0:18:56.57 if you're a patient and you might not

0:18:56.57 –> 0:19:00.397 be at or near a large academic center,

0:19:00.4 –> 0:19:02.968 and you get a prostate biopsy,

0:19:02.97 –> 0:19:05.434 for example, how important is it for

15

0:19:05.434 –> 0:19:08.928 you to get a second opinion on that

0:19:08.928 –> 0:19:11.288 biopsy from another human pathologist

0:19:11.29 –> 0:19:13.336 if a computer isn't readily available?

0:19:14.03 –> 0:19:16.97 That's a really critical question,

0:19:16.97 –> 0:19:19.22 and I think it's important to

0:19:19.22 –> 0:19:21.986 know in discussions with your

0:19:21.986 –> 0:19:24.506 physician whether a genitourinary pathologist

0:19:24.506 –> 0:19:27.272 has reviewed the slides and it's

0:19:27.272 –> 0:19:29.468 true that around the country there

0:19:29.468 –> 0:19:32.149 are just varying degrees of practice

0:19:32.149 –> 0:19:34.494 and varying volumes of practice,

0:19:34.5 –> 0:19:36.558 and so at a smaller hospital,

0:19:36.56 –> 0:19:39.08 maybe only a few prostate biopsies might

0:19:39.08 –> 0:19:41.816 be seen over a long period of time,

0:19:41.82 –> 0:19:44.865 and particularly in those cases where the

0:19:44.865 –> 0:19:47.355 pathologists may not feel as comfortable,

0:19:47.36 –> 0:19:50.312 or the treating physician may not

0:19:50.312 –> 0:19:53.77 feel as as comfortable, it's

0:19:53.77 –> 0:19:55.534 I think a useful step to seek

0:19:55.534 –> 0:19:57.25 a second opinion,

0:19:57.25 –> 0:20:00.344 and we see slides for second opinions

0:20:00.35 –> 0:20:02.247 all the time here from everyone.

0:20:02.25 –> 0:20:05.004 Actually from patients from treating

0:20:05.004 –> 0:20:07.59 physicians and from pathologists themselves,

0:20:07.59 –> 0:20:10.17 and this is an important quality

0:20:10.17 –> 0:20:12.25 to all these second opinions.

0:20:12.25 –> 0:20:14.938 And again we very commonly almost

0:20:14.938 –> 0:20:18.33 on a daily basis share cases here at

0:20:18.33 –> 0:20:20.99 Yale amongst our group of seven genitourinary

0:20:20.99 –> 0:20:22.28 pathologists

0:20:22.93 –> 0:20:25.807 And so are these second opinions when

0:20:25.81 –> 0:20:28.15 you go and you have your

0:20:28.15 –> 0:20:30.008 slides reviewed by somebody else?

0:20:30.01 –> 0:20:33.112 Or maybe the pathologists themselves sends

0:20:33.112 –> 0:20:35.786 it to another center to get reviewed

0:20:35.79 –> 0:20:37.64 if they're not quite sure

0:20:37.64 –> 0:20:38.75 about the diagnosis,

0:20:38.75 –> 0:20:40.598 is that covered by your insurance?

0:20:41.98 –> 0:20:43.532 Usually it is.

0:20:43.532 –> 0:20:46.388 So at least the cases that we

0:20:46.388 –> 0:20:49.04 receive here for second opinions.

0:20:49.95 –> 0:20:52.296 That's good to know.

0:20:52.3 –> 0:20:55.396 Is it ever the case where even

0:20:55.396 –> 0:20:57.538 if you go to a large academic

0:20:57.538 –> 0:20:59.15 center that it's worthwhile

0:20:59.15 –> 0:21:01.48 getting your slides reviewed by

0:21:01.48 –> 0:21:03.41 another large academic center?

0:21:03.41 –> 0:21:05.735 I mean, how much heterogeneity

0:21:05.735 –> 0:21:07.595 is there between experienced

0:21:07.595 –> 0:21:09.99 genitourinary pathologists for example?

0:21:10.58 –> 0:21:12.81 So since diagnosis

0:21:12.81 –> 0:21:15.46 and grading are still art,

0:21:15.46 –> 0:21:18.638 there can be differences of opinion amongst

0:21:18.638 –> 0:21:22.08 even expert and experienced genitourinary

0:21:22.08 –> 0:21:24.53 pathologists and these tend to be the

0:21:24.53 –> 0:21:27.229 rarer or more borderline cases.

0:21:28.08 –> 0:21:30.294 There's been a lot of research looking at

0:21:31.77 –> 0:21:34.665 variations or differences of opinion

0:21:34.665 –> 0:21:38.19 between pathologists and even between genitourinary

0:21:38.19 –> 0:21:39.02 pathologists,

0:21:39.02 –> 0:21:42.34 and even did a study where I looked

0:21:42.421 –> 0:21:45.043 at agreement with myself so I

17

0:21:45.043 –> 0:21:47.614 diagnosed and graded some slides and

0:21:47.614 –> 0:21:49.846 then came back sometime later

0:21:49.846 –> 0:21:52.055 to see if the diagnosis and grading

0:21:52.055 –> 0:21:54.439 were the same so the agreement is

0:21:54.439 –> 0:21:56.574 pretty good amongst genitourinary pathologists,

0:21:56.58 –> 0:21:59.272 but one should not hesitate in

0:21:59.272 –> 0:22:01.924 seeking a second opinion at another

0:22:01.93 –> 0:22:03.835 center with an established

0:22:03.835 –> 0:22:05.359 group of pathologists,

0:22:05.85 –> 0:22:07.719 but as we

0:22:07.719 –> 0:22:09.4 talk about that variability,

0:22:09.4 –> 0:22:11.758 all of these pathologists are looking

0:22:11.758 –> 0:22:14.87 at the same slides and I know that in

0:22:14.87 –> 0:22:17.34 other cancers we've talked on this show

0:22:17.34 –> 0:22:19.49 about this concept of

0:22:19.49 –> 0:22:21.832 heterogeneity that you might have a

0:22:21.832 –> 0:22:24.121 cancer that looks kind of different in

0:22:24.13 –> 0:22:28.144 one part than another and so I wonder,

0:22:28.15 –> 0:22:30.264 when you get these biopsies,

0:22:30.27 –> 0:22:32.797 we often

0:22:32.797 –> 0:22:34.859 send a core biopsy so

0:22:34.86 –> 0:22:37.15 a sampling of this tumor,

0:22:37.15 –> 0:22:38.41 how representative is that,

0:22:38.41 –> 0:22:40.639 and is it ever the case where

0:22:40.639 –> 0:22:42.815 you look at this and you

0:22:42.815 –> 0:22:44.726 kind of say

0:22:44.726 –> 0:22:46.777 I don't know that this is representative?

0:22:46.78 –> 0:22:48.775 We need to get more tissue or

0:22:48.775 –> 0:22:50.892 are you usually pretty happy

0:22:50.892 –> 0:22:53.268 with the sample that you get?

0:22:53.9 –> 0:22:57.012 So that's such a key question and

0:22:57.012 –> 0:23:00.036 really the practice of the biopsy

0:23:00.036 –> 0:23:03.627 as far as the prostate has changed so

0:23:03.627 –> 0:23:06.26 remarkably since when I was a resident.

0:23:06.26 –> 0:23:07.88 So back in the olden days,

0:23:07.88 –> 0:23:10.659 it was usually just one needle biopsy,

0:23:10.66 –> 0:23:12.73 digitally directed towards a palpable

0:23:12.73 –> 0:23:15.693 mass in the prostate by the examining

0:23:15.693 –> 0:23:18.549 physician and one single core was taken.

0:23:18.55 –> 0:23:20.32 So prostate cancer,

0:23:20.32 –> 0:23:22.68 heterogeneous concept of heterogeneity,

0:23:22.68 –> 0:23:24.906 and different areas of the prostate

0:23:24.91 –> 0:23:27.115 being actually of different grades

0:23:27.115 –> 0:23:28.879 and different aggressiveness

0:23:28.879 –> 0:23:30.921 is actually characteristic of

0:23:30.921 –> 0:23:32.965 prostate cancer and prostate

0:23:32.97 –> 0:23:35.22 cancer also tends to have multiple

0:23:35.22 –> 0:23:37.18 nodules within the same gland,

0:23:37.18 –> 0:23:38.77 so what's been a real advantage

0:23:38.77 –> 0:23:41.146 is medical advances in radiology,

0:23:41.146 –> 0:23:44.562 and there are expert radiologists here who have

0:23:44.562 –> 0:23:46.602 actually helped develop this technique,

0:23:46.61 –> 0:23:50.04 and that's a special type of MRI.

0:23:50.04 –> 0:23:53.095 Magnetic resonance imaging that's used

0:23:53.095 –> 0:23:57.519 with ultrasound to guide the

0:23:57.52 –> 0:23:59.98 needle placement within the prostate.

0:23:59.98 –> 0:24:02.976 So now rather than one needle core,

0:24:02.98 –> 0:24:07.644 we often receive anywhere from 20 to even

0:24:07.644 –> 0:24:11.567 30 individual needle cores per patient.

0:24:11.57 –> 0:24:14.356 And the reason is that the radiologist

0:24:14.356 –> 0:24:17.034 now can identify areas where they're

0:24:17.034 –> 0:24:19.854 suspicious of cancer and can specifically

19

0:24:19.854 –> 0:24:22.396 say based on their grading scheme,

0:24:22.396 –> 0:24:25.228 whether they think it's a lower

0:24:25.228 –> 0:24:28.07 risk or a higher risk case so

0:24:28.07 –> 0:24:32.12 I do feel good about the

0:24:32.12 –> 0:24:34.805 representation for most patients and when

0:24:34.805 –> 0:24:38.227 the patients have undergone this

0:24:38.227 –> 0:24:41.515 type of imaging by the radiologists.

0:24:42.501 –> 0:24:44.136 Even though multiple needle cores

0:24:44.136 –> 0:24:45.949 are placed in a single nodule,

0:24:45.95 –> 0:24:49.136 it's still possible that maybe

0:24:49.136 –> 0:24:52.849 a smaller high grade area was missed.

0:24:52.85 –> 0:24:54.368 Warning signs would be,

0:24:54.37 –> 0:24:57.146 what if the patient has a really high

0:24:57.146 –> 0:25:00.28 serum PSA prostate specific antigen level?

0:25:00.28 –> 0:25:02.452 Or what if this is radiologically

0:25:02.452 –> 0:25:04.4 a very aggressive looking lesion,

0:25:04.4 –> 0:25:06.848 but we don't see that under the microscope?

0:25:06.85 –> 0:25:10.21 Then I would worry about

0:25:10.21 –> 0:25:12.1 the needle maybe not sampling

0:25:12.1 –> 0:25:13.51 the worst of the cancer.

0:25:13.54 –> 0:25:15.256 Yeah, it goes back to that

0:25:15.26 –> 0:25:17.676 concept of being a bit of a

0:25:17.676 –> 0:25:19.614 detective that we talked about before

0:25:19.614 –> 0:25:22.348 the break and the fact that the

0:25:22.348 –> 0:25:24.572 pathologist is really a key part

0:25:24.572 –> 0:25:26.342 of this multidisciplinary team that

0:25:26.342 –> 0:25:28.659 you need to get information from.

0:25:28.66 –> 0:25:30.28 From the radiologist,

0:25:30.28 –> 0:25:31.495 from the surgeon.

0:25:31.5 –> 0:25:32.556 from the other physicians.

0:25:32.556 –> 0:25:34.316 who are involved

0:25:34.316 –> 0:25:36.67 in the case to kind of put all

0:25:36.67 –> 0:25:38.328 of the pieces together to make

0:25:38.328 –> 0:25:39.93 sure that it all makes sense.

0:25:40.17 –> 0:25:42.592 That's what I love about

0:25:42.592 –> 0:25:44.959 working here is working with so many

0:25:44.96 –> 0:25:47.24 bright and experienced physicians

0:25:47.24 –> 0:25:49.97 who are passionate about providing the

0:25:49.97 –> 0:25:53.12 highest level care and talking with

0:25:53.12 –> 0:25:55.622 them about what their perspective

0:25:55.622 –> 0:25:58.999 and view is on a specific patient.

0:25:59 –> 0:26:02.424 For example, if there

0:26:02.43 –> 0:26:06.084 is not a link made between pathology

0:26:06.09 –> 0:26:08.659 and what we see in the clinical setting

0:26:08.659 –> 0:26:12 that sort of correlation is

0:26:12 –> 0:26:13.44 clinicopathologic correlation and

0:26:13.44 –> 0:26:15.996 is so vital.

0:26:15.996 –> 0:26:18.688 Going back to that patient with pain in the rib.

0:26:18.69 –> 0:26:21.007 It was absolutely essential to know that

0:26:21.007 –> 0:26:23.297 the patient had a history of cancer

0:26:23.297 –> 0:26:25.5 10 years ago to establish firmly that

0:26:25.5 –> 0:26:27.738 cancer scene and what we would

0:26:27.738 –> 0:26:29.23 do is compare slides.

0:26:29.23 –> 0:26:31.757 That cancer in the rib biopsy

0:26:31.757 –> 0:26:34.527 was the same as the cancer in the

0:26:34.53 –> 0:26:35.73 salivary gland,

0:26:35.73 –> 0:26:38.127 so we do that commonly to look

0:26:38.127 –> 0:26:40.231 back at old slides to see if

0:26:40.295 –> 0:26:42.178 if cancer has come back and

0:26:42.178 –> 0:26:44.518 we think a cancer might

0:26:44.518 –> 0:26:47.45 have come back or spread so that

0:26:47.45 –> 0:26:49.37 comparison is a really important part

0:26:49.37 –> 0:26:51.696 of the detective work we do.

0:26:51.71 –> 0:26:54.475 And I think the other piece

0:26:54.475 –> 0:26:57.11 that's so important is that it's so

0:26:57.11 –> 0:26:59.47 critical in terms of what you do,

0:26:59.47 –> 0:27:01.158 especially in prostate cancer,

0:27:01.158 –> 0:27:03.268 to really nail down how

0:27:03.268 –> 0:27:05.19 aggressive this is because it is

0:27:05.19 –> 0:27:08.174 the difference these days between having

0:27:08.174 –> 0:27:11.258 more aggressive surgery

0:27:11.258 –> 0:27:14.299 or radiation versus watchful waiting.

0:27:14.3 –> 0:27:17.567 Tell us a little bit more about how your

0:27:17.567 –> 0:27:20.09 decisions impact treatment and prognosis?

0:27:20.87 –> 0:27:22.742 After establishing a

0:27:22.742 –> 0:27:24.614 diagnosis of prostate cancer,

0:27:24.62 –> 0:27:28.134 we assign the Gleason grade or score

0:27:28.14 –> 0:27:31.204 and that is a grade number we give

0:27:31.204 –> 0:27:33.598 for every single prostate cancer

0:27:33.598 –> 0:27:37.795 needle core in every case and a great

0:27:37.795 –> 0:27:40.52 group for that particular biopsy.

0:27:40.52 –> 0:27:42.97 So if a patient had 10 positive

0:27:42.97 –> 0:27:44.959 cores with cancer in each one,

0:27:44.96 –> 0:27:47.402 we would assign an individual

0:27:47.402 –> 0:27:49.03 grade to each one,

0:27:49.03 –> 0:27:51.249 and actually I just gave a

0:27:51.249 –> 0:27:53.346 lecture this morning to the pathology

0:27:53.346 –> 0:27:55.399 residents on grading and staging.

0:27:55.399 –> 0:27:59.16 So it is one of the most critical

0:27:59.16 –> 0:28:02.376 things we do because grade is such

0:28:02.376 –> 0:28:05.872 a dominant prognostic indicator for us.

0:28:05.872 –> 0:28:07.736 For the patients physician,

0:28:07.74 –> 0:28:08.634 for everyone,

0:28:08.634 –> 0:28:11.316 and the patient themselves.

0:28:12.5 –> 0:28:15.044 For example, a grade Group One in a patient

0:28:15.05 –> 0:28:18.284 with a lower PSA might consider

0:28:18.284 –> 0:28:20.44 along with their physician,

0:28:20.44 –> 0:28:22.66 the physician might consider active

0:28:22.66 –> 0:28:24.88 surveillance or careful monitoring of

0:28:24.941 –> 0:28:27.335 that cancer compared to a grade Group

0:28:27.335 –> 0:28:29.604 5 where everyone would agree this

0:28:29.604 –> 0:28:31.999 patient definitely needs active therapy.

0:28:32.81 –> 0:28:35.127 Doctor Peter Humphrey is a professor of

0:28:35.127 –> 0:28:37.608 pathology at the Yale School of Medicine.

0:28:37.61 –> 0:28:39.102 If you have questions,

0:28:39.102 –> 0:28:41.34 the address is cancer answers at

0:28:41.34 –> 0:28:43.602 yale.edu and past editions of the

0:28:43.602 –> 0:28:45.888 program are available in audio and

0:28:45.888 –> 0:28:48.366 written form at Yale Cancer Center Org.

0:28:48.37 –> 0:28:50.338 We hope you'll join us next week to

0:28:50.338 –> 0:28:52.236 learn more about the fight against

0:28:52.236 –> 0:28:53.921 cancer here on Connecticut Public

0:28:53.921 –> 0:28:55.6 radio funding for Yale Cancer

0:28:55.6 –> 0:28:57.205 Answers is provided by Smilow

0:28:57.205 –> 0:28:59.998 Cancer Hospital and AstraZeneca.